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Finnish Bioeconomy in 2050 – Visions of Future Environmental Professionals

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Finland and the European Union, among others, are promoting bioeconomy as a new form of economy. According to the EU, the bioeconomy comprises those parts of the economy that produce renewable biological resources, such as crops, forests, fish, animals and micro-organisms, or use them to produce food, materials and energy. In order for transition to have public legitimacy and engagement, it is important to understand different stakeholders' views of bioeconomy. Therefore in this article we focus on future environmental professionals' views of bioeconomy and compare them to the official definitions. We collected essays about Finnish bioeconomy in 2050 among 47 future environmental professionals who were currently studying at universities in the Helsinki region. The one-page essays were written in the spring 2017. Their content was analysed through nine themes (energy, housing, transport, food, other consumption, individuals, society, drivers, and definition of bioeconomy). Respondents' views were reduced to three-four alternative future images per each theme and then combined into overall future images. According to the results, respondents' visions were much more versatile and varied than the images portrayed by the Finnish and EU policies. The visions included dystopic images as well as critical views regarding the consumption-based lifestyles of today. The visions included changes to everyday life and practices, as well as to prevailing values and attitudes. For example, dietary changes such as increased vegetarianism and reduced consumption of meat and dairy products were very common. On the other hand, local food production and self-sufficiency were preferred by many respondents. In addition, the new technologies and materials envisioned were not only bio-based. Instead, solar and wind power emerged as particularly important energy forms. Even nuclear power was mentioned, which demonstrates how the focus of these visions was often carbon-neutrality rather than renewability or biological resources. Altogether these visions demonstrate that even among future environmental professionals the concept of bioeconomy is far from clear. It can be hypothesized that the term is even less known among the Finnish people at large. It is also likely that current research and promotion activities do not take into account the various societal and everyday dimensions of bioeconomy, if they only focus on the technological and economic aspects of the transform. We conclude that the aim to transform the Finnish society towards bioeconomy should be discussed more widely, and its definition, legitimacy, and societal impacts should be studied further.

Key words: bioeconomy, future visions, young adults

Introduction

Bioeconomy is a politically important theme, but so far it has not been properly defined by research, politicians or other experts. There are several definitions and even parallel concepts in use, such as bio-based economy and knowledge-based bioeconomy (KBBE), which demonstrates that the concept has not yet been stabilized (Besi and McCormick 2015). However, all these concepts and their definitions share the idea of a sustainable economy, in which renewable resources are used in production instead of fossil resources. Consequently, bioeconomy can be defined as a transition from a fossil-based society to bio-based society that uses renewable biomass in products and energy (Bosman and Rotmans 2014, Besi and McCormick 2015, Bosman and Rotmans 2016, Efken et al. 2016). The concept of bioeconomy has also met with criticism. In particular, the criticism has to do with intertwining bioeconomy with sustainability (Besi and McCormick 2015, O'Brien et al. 2015, Ramcilovic-Suominen and Pülzl 2018). The importance of sustainable production is considered a main reason for transition to bioeconomy that would be based on the use of biomass in products and energy. Yet, sustainability is not an implicit result of bioeconomy, i.e. the use of renewable resources does not make production inherently sustainable (Besi and McCormick 2015). In Finland, for example, public discussion has focused on the acceptable level of logging. Finland has large wood reserves, which can withstand increased logging, but there have been concerns regarding trade-offs, such as biodiversity losses, alternative uses of forests (recreation, picking berries, etc.), and changes in carbon sinks. According to Ramcilovic-Suominen and Pülzl (2018), sustainability is easily used as a concept that “sells” without undertaking any real changes to current policies, strategies and actions. In the EU bioeconomy framework, economic dimension of the sustainability prevail over social and environmental dimensions (Ramcilovic-Suominen and Pülzl 2018).

Due to the novelty of the concept, bioeconomy strategies will significantly influence how future priorities are defined and implemented (Levidow et al. 2012, Besi and McCormick 2015). As such, Finland has excellent prerequisites for bio-based economy. The supply of forests and presence of forestry and related industries are strong, work force is highly educated, business and research sectors cooperate and innovative capacity is, thus, notable (Bosman and Rotmans 2016). However, it has been also noted that citizens’ values, interests, and experiences have not been sufficiently taken into account in the governance of bioeconomy transition (Mustalahti 2018). Consequently, it is important to analyse how the concept is defined and understood by the decision-makers on one hand and by the public on the other hand. The aim of this paper is to analyse bioeconomy essays written by future environmental professionals currently studying at universities in the Helsinki region. The essays are further elaborated in relation to bioeconomy strategies conducted by the EU and Finland. The research questions are: 1) How is bioeconomy defined in strategies conducted by the EU and Finland? What aspects of bioeconomy are emphasized? 2) How do students define bioeconomy in their essays? What are the main drivers and barriers of bioeconomy? What aspects of bioeconomy are emphasized?

Bioeconomy strategies of EU and Finland

The EU has strongly underlined the importance of transition to bioeconomy focusing on: investments in research, innovations and skills; reinforcement of policy interaction and stakeholder engagement; and enhancement of markets and competitiveness (European Commission 2012). European countries, regions and industries have accordingly created strategies focusing on research & innovation, collaboration between industry, enterprises and research, prioritizing optimized use of biomass, and funding the development of bio-based activities. Consequently, these are likely to become the basic components of the bioeconomy transition in Europe (Besi and McCormick 2015).

The national strategy of Finland characterizes bioeconomy as a means for achieving a low-carbon and resource efficient society (Ministry of Employment and the Economy 2014). In this strategy, bioeconomy means an economy that uses renewable resources for producing food, energy, products and services. The objective is economic growth and new jobs by means of increase in bioeconomy-based business and value-added products and services, at the same time securing functioning ecosystems. The

Finnish strategy focuses on the efficient use of biomass from waste streams and a high level of technological development. The national strategy defines bioeconomy as an opportunity for Finland and considers that the chances of Finland to achieve a strong bioeconomy are good. Climate change and global challenges of limited natural resources are defined as providing advantages to the Finnish economy. The Finnish strategy encourages Finnish stakeholders to focus on areas where they are already strong, such as forestry and a high level of biotechnology. The Finnish strategy also focuses on a close relationship of Finnish people with nature, and includes the health and welfare effects of natural environments on humans in bioeconomy. Both the national and EU strategies see the need for transition to bioeconomy arising from large problematic trends: the unsustainable use of natural resources, acceleration of climate change, loss of biodiversity, increasing world population, as well as positive changes in consumer trends. Moreover, the EU strategy mentions the twofold increase in world meat consumption.

The EU strategy refers to many challenges on the way to bioeconomy, such as the fragmented policy environment, pending legislative issues, the information gap between science and society, the limited biological resources and trade-offs between different uses of biomass. EU strategy focuses strongly on research and innovation and enabling industrial technologies. A more coherent policy framework is also needed, as well as improved communication with the public through participatory models that engage citizens, society and policy-making. The EU strategy also analyses the potential risks of bioeconomy to biodiversity and global food security resulting from competing uses of biomass for food vs. other purposes. Both bioeconomy strategies focus on large-scale trends and societal, policy and economic barriers and drivers. The role of citizens is more emphasized in the EU strategy as compared to the national strategy: the EU strategy underlines the need for participatory activities to engage citizens into research and innovation processes whereas the Finnish strategy mentions changing consumer trends, in particular ethical consumerism, as one driver toward bioeconomy. The bioeconomy strategies have been criticized for focusing on the role of industrial sectors in the management of biological resources whereas the social sustainability aspect has received less attention (Schmid et al. 2012, Mustalahti 2018).

Material and methods

We collected essays about Finnish bioeconomy in 2050 from 47 future environmental professionals who were studying at universities in the Helsinki region. The one-page essays were written in the spring 2017. The respondents wrote the essays with the computer and sent the essays to the researcher via e-mail. Participants' gender, age and main subject were asked. The participation was voluntary and the respondents received a free lunch or coffee ticket to the university cafeteria as a compensation for participation.

The respondents were asked to envision Finland in the year 2050, with the assumption that the transition to bioeconomy has taken place. We described Finland as a society that uses natural resources, such as food, water and forests, in an economically, environmentally and socially sustainable way. As examples of this, we mentioned the use of bio-based products; the use of biological processes in productions; and circular economy. Furthermore, we posed questions to assist the respondents in writing the essay. The questions concerned housing, energy and transport, and food. We asked the respondents to consider the issue from societal (laws and regulations; science; societal challenges) and individual perspective (attitudes, values, skills, knowledge, human relations). The respondents were not obliged to cover all topics in their essays. Most of the participants were female (37 females, 8 males, 1 other, 1 did not answer) and most of them studied environmental sciences as their major subject (43 environmental sciences, 1 alimentary sciences, 1 chemistry, 1 environmental engineering, 1 did not answer). The average age of the respondents was 23.8 years (SD=5.6).

The purpose of the analysis was to identify a few most characteristic future visions from the data. We used thematic analysis that is a flexible method for identifying patterns or themes within data (Braun and Clarke 2006). Initially, we sorted the data under the working themes that were also mentioned in the essay instructions: 1) consumption (energy, housing, transport, food, other consumption), 2)

individuals vs. society, 3) drivers, and 4) overall definition of bioeconomy. After that, researchers inductively identified three to four themes within each of these. In the following discussions, researchers compared these themes to each other and the final interpretation was developed. We describe the themes as dimensions. Moreover, we describe the drivers of bioeconomy separately.

Results

The essays varied in their contents: most of them focused on some themes and did not mention others. Here we discuss the dimensions which emerged as particularly important elements of variation.

Drivers and barriers

The main driver behind a transition to bioeconomy was considered to be climate change. By 2050, its impacts were seen to extend to everyday life. Climate change has had direct and indirect negative impacts to Finland. However, a bioeconomy Finland can be a good place to live. In the best case, Finland has created positive drivers and is a leading bioeconomy in the world in 2050. Focus on education has created new innovations to energy production, housing and food production. The negative climate impacts have increased awareness of the state of the world and pushed values and attitudes towards more environmentally sustainable direction. In positive and neutral visions Finland reacts to climate change, and is able to control or even take advantage of it through Finnish actions. However, the negative drivers do not necessarily lead to active creation of state-driven drivers, such as new resources in education and research. Mistakes in climate change mitigation and adaptation may lead to bad results. The state has harnessed natural resources to energy production, using heavy sanctions to direct adaptation, creating social inequalities and social unrest. Some respondents believed that neither Finland nor the world as a whole has sufficient societal capacity to a bioeconomy transition. Upkeeping economic competitiveness is seen as too important. Technological development may be too slow, and expenses too high. Foremost, values and attitudes may prohibit the transition.

The dimensions of bioeconomy in essays

Three main dimensions emerged as particularly important elements of variation in the essays. The first concerned the **lifestyles** depicted. Although the essays contained views about the new technologies that would be in use by 2050, the lifestyles of people were not necessarily very different from those of today. A car would still be used, even if its tank was filled with biofuel rather than fuel from fossil oil, and even if it may drive itself. In the essays, houses are energy efficient which has lowered need for heating, but air conditioning has increased. There is much international tourism, but some of it takes place via railway tunnels to Stockholm, Sweden and Tallinn, Estonia. Also virtual travel is mentioned. Essays also include references to circular economy: industry side-streams are taken to use and waste is not incinerated but instead recycled effectively. Food culture still favours meat or meat-like products. New technologies are embraced, such as genetically modified organisms (GMO), cultivated meat and non-meat protein sources such as insects and “pulled oats”.

However, many essays portrayed a lifestyle that was radically different from the current mainstream lifestyles in Finland. They describe a modest lifestyle where crafts and repairing skills are valued. It is an image of self-sufficiency combined with community spirit and reduced consumption. What distinguishes it from pure “back to the past” thinking is that technology is still used and developed. For example, electronics is a compulsory subject at schools, and efficient waste sorting and recycling technologies are developed. Energy production relies on new technologies such as photovoltaics, wave energy and ground source heat pumps. People return to old practices of gathering or growing (some of) their food by themselves. People buy less, mass production is reduced, and goods are designed to last and are made of environmentally sustainable materials. International travel is reduced in favour of domestic tourism. Many people live in ecovillages. Cities have higher buildings, smaller apartments, and some communal living, all of which stops the urban sprawl and makes it easier to walk or cycle to work or to use services. Balconies, walls, cellars and particularly roof tops are used for cultivation.

Schools teach horticulture. The consumption of domestically produced berries and the picking of wild berries, herbs and mushrooms are common and trendy; the consumption of imported fruit is not. People favour vegetarian, seasonal foods.

Second main finding is how unclear and undefined concept bioeconomy remains, even among future environmental professionals. It seems that many essays contain an image of what the writer considers sustainable, whether that is related to biological resources or not. For example, an important theme running through the essays is energy. It is possible to identify three main approaches to energy production. First, some authors favour nuclear power (in addition to renewable energy forms such as solar power), expect that by 2050 fusion energy is in at least some use, and consider the use of biomass burning to be both inefficient and harmful to the climate. Second, some authors describe a future based on a mix of renewable non-biological sources, particularly solar but mentioning also wind power, hydro power, ground source heat pumps and other geothermal energy, air source heat pumps, and wave energy. Biological sources such as wood and biogas are used to a small degree. Third, some essays focus on biological resources. The more optimistic ones state that biofuels are made out of algae or wastes from agriculture, industry or households. The more pessimistic ones envision extensive use of wood for biofuels, criticizing the impacts to Finnish forests and swamps. As one respondent described: “Forests are seen as fuel production facilities rather than oases of life.”

In addition to energy, some authors emphasize the way biological (particularly wood-based) materials will replace non-renewable materials. For example, paper and cardboard as well as bio-plastics are seen to replace plastic in the future. Plastic bags will be replaced by durable fabric bags. Use of wood in construction is seen as particularly sensible, as wooden buildings constitute long-term carbon stores. Fabrics and chemicals are also mentioned as new products that can be made out of wood, hemp or other biomass. Even cars were sometimes thought to be made largely of wood.

An important and recurring topic in the essays was vegetarianism or reduction of meat and/or dairy consumption. Some meat consumption is still included in many essays. Meat is reserved only for special occasions, or there are exceptional meat days in school lunches (as opposed to current specific vegetarian days). There is also a change in how food is produced, as many authors describe cultivation in cities, by households. There is emphasis on food produced locally and marketed through food circles etc. Even meat is thought to be produced in small farms and sold primarily locally. Some authors note that game would still be consumed. In many essays the increased self-sufficiency in terms of food is mentioned. This would take place both on the level of individual households and on the country scale. This emphasis on food may be explained by the question posed to the students, as it specifically mentioned food, as well as the central role food has been assigned in reaching a more sustainable lifestyle. There has been a lot of discussion about the climate impact of cattle, in particular, and many environmental university students are either vegan, vegetarian or at least try to reduce their meat consumption. A social media challenge to have a “meatless October” started in 2013 in Finland and has inspired much public discussion.

Other current issues have also emerged into the images of Finland in 2050, even though they do not have a direct relation to bioeconomy. Examples include using bicycles and train in lieu cars, favouring non-packaged goods, and living in smaller apartments. Circular economy has been considered important, whether the term has been used in an essay or not. Mostly the discussion has been about avoiding and recycling waste, and specifically recycling nutrients, avoiding runoff to waterbodies. Changes in the way we do work have also been mentioned, as increased automatization and a change from retail to sharing and repairing services.

The third dimension that shows variation in the overall attitude towards a bioeconomy – is it seen as something sustainable or risky. The most positive images portray a harmony between humans and (the rest of) the nature. People value nature, and environmental protection has become part of economic profits. Materialism and economic success have lost their lustre, and a sense of wellbeing has become a central societal value. Community spirit is increased.

The negative images are largely centred on the (over)use of biological resources and the human relation to nature. Much of biodiversity, particularly in forests, has been lost. Climate change remains an immense problem. People have a more distant relation to nature, and nature is seen primarily as resources for the economy. In some essays natural resources have been bought by international corporations. The legislation directing a transition towards bioeconomy is of a massive scale.

Discussion and conclusions

This study analysed future environmental professionals' visions of future bioeconomy in Finland. The analysis revealed some similarities with bioeconomy strategies but also some differences. It is likely that the future environmental professionals are relatively knowledgeable about bioeconomy and related discussions that are part of their studies. As compared to official strategies, respondents' visions were broader and included elements that were both favourable and critical, as well as elements that are totally missing from official strategies. On the other hand, some elements in official strategies were not mentioned in the essays. While many essays were positive, the important difference between bioeconomy strategies and future professionals' images was the element of criticism: some essays portrayed a future where bioeconomy has not taken place, or a society with a chaos and a plenty of societal and environmental problems. Bioeconomy strategies portray future bioeconomy in a positive light, even if they acknowledge some risks.

Another important theme in essays was that of lifestyle change. Bioeconomy strategies strongly emphasize technological change but not a change in lifestyles. According to Mustalahti (2018), a technological revolution and even increased consumer awareness do not necessarily lead to change in behaviours or lifestyles. It has been argued that bioeconomy does require behaviour changes in society if it is to be a means for tackling major global challenges (Heiskanen et al. 2014, Mustalahti 2018). Moreover, many essays discussed a change in values, which is not mentioned in bioeconomy strategies. Behaviour changes described in the essays portrayed nostalgia and return to the past, requiring and acquiring skills that were once lost, and a lifestyle in the harmony with nature. This kind of lifestyle change can be seen to be in a sharp contrast to technology-oriented official bioeconomy visions.

Previous research has extensively explored the official discourses of bioeconomy whereas individuals' discourses have received less attention. A discrepancy between the official visions and the citizens' visions can create a barrier to bioeconomy transition. One reason for this may be that citizens have not had the opportunity to participate in bioeconomy strategy development processes. Such discrepancies may result in legitimacy crises, if important segments of society do not see a bioeconomy transition as a possible or desirable future. Future environmental professionals are likely to be participating in the bioeconomy transition in future and they may lead the process to directions that have not so far been anticipated.

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